DECLARATION

I, Shigetomo UMITSU of FUJIMURA & ASSOCIATES, do hereby solemnly and sincerely declare:

1. That I am well acquainted with the Japanese and English Languages, and
2. That the attached document
   Patent Specification entitled
   "RECORDING AND REPRODUCING DEVICE"

is a true translation into the English language.

AND I MAKE THIS SOLEMN DECLARATION conscientiously believing the same to be true and correct.

Tokyo, February 20, 2004

Shigetomo UMITSU
FUJIMURA & ASSOCIATES

SU/aw

PATENT OFFICE
JAPANESE GOVERNMENT

This is to certify that the annexed is a true copy of the following application as filed with this Office.

Date of Application: April 24, 2000

Application Number: Japanese Patent Application No. 2000-123264

Applicant(s): Pioneer Corporation

March 9, 2001

Commissioner, Patent Office
Kouzou OIKAWA (Seal)
Cert. No. 2001-3016077

[Name of Documents] Patent Application

[Reference Number] 54P0675

[Filing Date] April 24, 2000

[Address] To the Commissioner of Patent Office

[International Patent Classification] G11B 19/00

G01C 21/00

[Inventor]

[Address] 6-1-1, Fujimi, Tsurugashima-shi, Saitama 350-2288, Japan, c/o Corporate Research and Development Laboratory, Pioneer Corporation

[Name] Koichi NAGAKI

[Inventor]

[Address] 6-1-1, Fujimi, Tsurugashima-shi, Saitama 350-2288, Japan, c/o Corporate Research and Development Laboratory, Pioneer Corporation

[Name] Kazunori MATSUO

[Inventor]

[Address] 6-1-1, Fujimi, Tsurugashima-shi, Saitama 350-2288, Japan, c/o Corporate Research and Development Laboratory, Pioneer Corporation

[Name] Keiichi YAMAUCHI

[Inventor]

[Address] 6-1-1, Fujimi, Tsurugashima-shi, Saitama 350-2288, Japan, c/o Corporate Research and Development Laboratory, Pioneer Corporation

[Name] Michihiro KANEKO

[Inventor]

[Address] 6-1-1, Fujimi, Tsurugashima-shi, Saitama 350-2288, Japan, c/o Corporate Research and Development Laboratory, Pioneer Corporation

[Name] Tomo WATANABE

[Applicant]

[Discrimination Number] 000005016

[Name] Pioneer Corporation

[Agent]

[Discrimination Number] 100063565

[Attorney]

[Name] Nobuatsu KOBASHI

[Indication of charges]

[Prepayment Register Number] 011659

[Amount of Payment] ¥21,000

[List of Attached Documents]

[Name of Document] Specification 1

[Name of Document] Drawing(s) 1

[Name of Document] Abstract 1

[Necessity of Proof] Necessary

Information of the Applicatnt's History

Discrimination Number	000005016
1. Changed Date:	August 31, 1990
[Reason of Change]	New Registration
Address:	4-1, Meguro 1-chome, Meguro-ku, Tokyo, Japan
Name:	Pioneer Electronic Corporation

OIPE
FEB 2 6 2004
PATENT & TRADEMARK OFFICE
JC187

[Document Name] SPECIFICATION

[Title of the Invention]

RECEIVED
MAR 0 3 2004
Technology Center 2600

RECORDING AND REPRODUCING DEVICE

[Scope of claim for Patent]

[Claim 1] A recording and reproducing device driven and controlled by a power supply voltage in a vehicle, comprising:

a time counting means for starting a time counting operation based on a prescribed signal related to a key switch in said vehicle; and

a controller for driving and controlling said recording and reproducing device when a first prescribed time period has been counted by said time counting means.

[Claim 2] A recording and reproducing device driven and controlled by a power supply voltage in a vehicle, comprising:

a head for reading/writing information from/to a recording medium mounted to said recording and reproducing device;

a head driving means for giving a driving instruction to said head;

a time counting means for starting a time counting operation based on a prescribed signal related to a key switch in said vehicle; and

a head movement allowing means for allowing the head to be moved by said head driving means when a first prescribed time period has been counted by said time counting means.

[Claim 3] A recording and reproducing device as recited claim 1 or 2, further comprising a power supply means for providing a power supply voltage to each part of said recording and reproducing device in association with the key switch in said vehicle,

wherein said counting means starts the time counting operation after the power supply voltage of said power supply means has been provided to said recording and reproducing device by said key switch.

[Claim 4] A recording and reproducing device as recited in any one of claims 1 to 3, further comprising a voltage value monitoring circuit for monitoring a voltage value at said power supply means; and

a controller for detecting a voltage value result at said voltage monitoring circuit after said first prescribed time period, controlling said time counting means to count time again when said voltage value is lower than a prescribed value, and driving and controlling said recording and reproducing device when a second prescribed time period has

been counted by said time counting means.

[Claim 5] A recording and reproducing device as recited in any one of claims 1 to 4, further comprising forcible moving means for forcibly moving said head to a retreat position when said power supply voltage in said vehicle is cut off.

[Claim 6] A recording and reproducing device as recited in any one of claims 1 to 5, wherein

said forcible moving means forcibly moves said head to a retreat position by providing said head driving means with a counter electromotive force generated by the inertial rotation of a spindle motor driving said recording medium to rotate.

[Claim 7] A recording and reproducing device as recited in any one of claims 1 to 6, further comprising an engine start detecting means detecting an engine start of the vehicle,

wherein said recording and reproducing device is driven and controlled when an engine start of the vehicle is detected by said engine start detecting means during the time count operation of said time counting means counting said first prescribed time period.

[Detailed Description of the Invention]

[Technical Field to which the Invention pertains]

The present invention relates to a recording and reproducing apparatus, and particularly to a recording and reproducing apparatus for mounting in a vehicle, which is suited for coping with an instantaneous rupturing at the engine start time.

[Prior Art]

The hard disk devices (HDD) have widely spread as an external storage device for a personal computer. Meanwhile, the HDD has been reduced in price as the recording density has increased, and today, some home electric appliances have an internal HDD. The HDD can store a considerable amount of video and music contents and various products with an HDD are on the way to the market. Car audio equipment is a prospective item to be provided with an HDD. Car navigation systems mainly use DVDs as the storage, while the use of HDD is expected in the future.

The basic construction of an HDD is shown in Fig. 9. Depicted here is a ramp loading type HDD in which a magnetic head 51 provided at a tip end of an actuator 54 is mechanically raised from the magnetic disk surface to float.

As shown, the magnetic head 51 attached to the actuator

54 is provided movably in the radial direction (denoted by the arrow) of the magnetic disk 53, and the magnetic head 51 is pressed against the surface of the magnetic disk 53 by the elasticity of a suspension 57. Meanwhile, the rotation of the magnetic disk 53 controls the distance between the disk surface of magnetic disk 53 and the magnetic head 51 to be several tens μm by the aerodynamic floatation acting upon the magnetic head 51. In an inactive state, the magnetic head 51 is positioned at a retreat position where the head 51 is placed over the tapered portion 56 of a ramp 55 formed at one end of a casing frame 50.

The positional relation between the magnetic head 51 and the ramp 55 is shown in a sectional view in Fig. 10. As shown, the ramp 55 positioned in the vicinity of the outer circumference of the magnetic disk 53 has the tapered portion 56 which gradually away from the surface of the magnetic disk 56, outward from the outside peripheral portion. The magnetic head 51 is positioned (location a) to produce a prescribed distance on the the magnetic disk 53 at the time of reading/writing information from/to the magnetic disk 53 (at the operating time). In an inactive state (unloaded state), the head is placed over the said tapered portion 56 as denoted by the arrow in the figure, stands by at a retreat position (position b).

[Problem to be solved by the Invention]

Incidentally, the above described HDD has a function called emergency unloading. The emergency unloading function is to forcibly move the head to the retreat position in order to prevent the magnetic disk 53 from being damaged by the head when both of the power supply voltages to a spindle 52 and a motor for driving the magnetic head 51 fall down. A power supply is necessary to carry out this emergency unloading function. Meanwhile, it is known that counter electromotive force generated by the inertial rotation of the spindle motor 52 is used to perform the operation when the power supplies are both down as described above.

When the HDD described above is applied for mounting in the vehicle such as in a car audio product or a car navigation system, as the so-called instantaneous rupturing may occur at the engine start time, it is highly possible that the above described emergency unloading operation is performed each time the engine is started.

Fig. 11 shows a power supply line of a vehicle mounted audio product. As shown in Fig. 11, a backup power supply (normal power supply) line to which power is normally supplied and an accessory (ACC) power supply line, which supplies a power source interlocking with a key switch, are connected to the vehicle mounted audio product.

The manner of power supply, at the start of the engine,

of the vehicle mounted power supply circuit to which the electric power is supplied via both of the power supply lines is shown in the form of timing charts in Fig. 12. In this figure, (a) shows how the normal power supply voltage changes, (b) shows the manner of the power supply of ACC. The timings (I), (II), (III) and (IV) shown in the figure correspond to positions of the key switch of the engine key. In the timing (I), the engine key is at the "ACC position" where power is supplied to an audio product, for example. The timing (II) shows a case where, the engine key is at the "ON position" where power is supplied to a power window, for example. The timing (III) shows a case where, the key switch is in the "ST position" where power is supplied to the engine. The timing (IV) shows the case where the engine has started and the engine key is again returned to the "ON position."

During the operation as described above, there is a case in which, at the start of the engine, the voltage in the audio product's side drops (instantaneous rupturing) by the power supply voltage being used to start the engine (during the period from (III) to (IV) in Fig. 12).

Like this, if the HDD described above is applied for in-vehicle use, there is a possibility of occurrence of the instantaneous rupturing at the start of the engine, and it is likely to cause the above described emergency unloading every time the engine is started. In the emergency unloading operation, the counter electromotive force of a spindle motor is used to force the head to move. Therefore, in products for vehicles, the magnetic head 51 more often collides with the tapered portion 56 of the ramp 55 before the head 51 reaches the stand-by position b of the ramp 55 than the case of other kinds of products such as personal computers. More specifically, so far as the use in a vehicle, durability against collision must be considered since the possibility of the occurrence of the instantaneous rupturing increases each time of the engine start-up.

The present invention has been made in view of the circumstances described above, and it is an object of the present invention to provide an information recording and reproducing device for use in a vehicle in which, in an HDD for vehicle, a time counting means that performs a time count operation based on a predetermined signal associated with a key switch of the vehicle is used, and the occurrence of an emergency unloading at the start of the engine is prevented by performing the drive of the HDD or the drive of the floating head slider 51 when a predetermined time has been counted by the time counting means, to prolong the life of the floating head slider and to realize the improvement of the reliability as an HDD.

[Measure taken to solve the problem]

In order to achieve the above described objects, the present invention recited in claim 1 pertains to a recording and reproducing device which is driven and controlled by a vehicle power supply voltage in a vehicle. The recording and reproducing device includes a time counting means for starting a time counting operation based on a prescribed signal related to a key switch in the vehicle and a control means for driving and controlling the recording and reproducing device when a first prescribed time period has been counted by the time counting means.

The invention recited in claim 2 pertains to a recording and reproducing device which is driven and controlled by a power supply voltage in a vehicle. The recording and reproducing device further comprises a head for reading/writing information from/to a recording medium mounted in the recording and reproducing device, a head driving means for giving a driving instruction to the head, a time counting means for starting a time counting operation based on a prescribed signal related to a key switch in the vehicle and a head movement allowing means allowing the head to be moved by the head driving means when a first prescribed time period has been counted by the time counting means.

The invention recited in claim 3 features, in a recording and reproducing device recited in claim 1 or 2, that a power supply means for providing a power supply voltage to each part of the recording and reproducing device in connection with the key switch in the vehicle is further provided, and the time counting means starts counting operation after the power supply voltage of the power supply means is supplied to the recording and reproducing device by the key switch. The invention recited in claim 4 features, in the recording and reproducing device recited in any one of claims 1 to 3, that a voltage monitoring circuit for monitoring a voltage value at the power supply means is further provided and the device is further provided with a controller that detects a voltage value result at the voltage monitoring circuit after the first prescribed time period, and controls the counting means to count time again when the voltage value is lower than a prescribed value, and controls the recording and reproducing device to be driven when a second prescribed time period has been counted by the time counting means.

The invention recited in claim 5 features, in the recording and reproducing device recited in any one of claims 1 to 4, that a forcible moving means forcibly moving the head to a retreat position when the power supply voltage at the vehicle is cut off is further provided. The invention recited in claim 6 features, in the recording and reproducing device recited in any one of claims 1-5, that the forcible moving means forcibly moves the head to a retreat position by providing the head driving means with counter electromotive

force generated by the inertial rotation of a spindle motor driving the recording medium to rotate. Furthermore, the invention recited in claim 7 features, in the recording and reproducing device recited in any one of claims 1-6, that the recording and reproducing device further includes an engine start detecting means for detecting a start of an engine in the vehicle. The recording and reproducing device is driven and controlled when an engine start of the vehicle is detected by the engine start detecting means during the operation of the counter counting said first prescribed time period.

By the above-described constructions, for a vehicle without a voltage drop at the start of the engine, the engine start can be detected by monitoring using a timer. Meanwhile, for a vehicle with a voltage drop, a recording and reproducing device can be started in an earlier timing. The head is allowed to move after the detection time point, so that emergency unloading at the start of the engine may be minimum, or avoided. Therefore, emergency unloading occurrence may be reduced, which reduces the number of collisions between the head and the ramp, so that the head may have a prolonged life and the recording and reproducing device may have improved reliability as an HDD for vehicle.

[Embodiment of the Invention]

Fig. 1 is a block diagram showing the configuration of a car navigation system provided with a recording and reproducing apparatus according to the present invention. Herein, an HDD is used rather than a DVD as a map information storing part for a car navigation system by way of illustration. Note that while the present invention is not limited to the car navigation system, but also applicable to anything provided with an HDD in audio product for vehicle, the car navigation will be described as one embodiment. The recording and reproducing apparatus according to the present invention includes a host CPU 11 as a main feature of control, a ROM 12, a RAM 13, a timer LSI 14, a hard disk drive (HDD) 15, a sensor 16, a GPS receiver 17, an interface 18, an input device 19, a display 20, a display controller 21, a display memory 22, a voice sound processing circuit 23, a speaker 24, a power supply circuit for vehicle 25, a hard disk controller HDC 26, and a backup RAM 27.

The host CPU 11 achieves general control of navigation such as searching the location of a destination and directing a route based on programs stored in the ROM 12 and the RAM 13, and also controls units 12, 13, 14, 27, 19, 23, 18, 26 and 21 connected to a system bus 10. A timer LSI 14 has its time count value set in a programmable manner by the host CPU 11, and issues an interrupt at time up to let the interrupt processing routine to take over the processing. Here, the driving timing of the HDD after the start of the engine is

specified.

The HDD 15 is provided with a measure to prevent emergency unloading according to the present invention, and is connected with the system bus 10 through the HDC 26. The HDC 26 carries out format control of a magnetic disk mounted to the HDD 15, and also serves as a host interface and an HDD interface. The sensor 16 denotes a group of sensors required for autonomous traveling as a car navigation system, and for example includes a vehicle speed sensor and a gyro sensor. The sensor 16 is connected with the system bus 10 through the interface 18. The interface 18 is supplied with the output of the GPS receiver 17, and hybrid traveling control based on the GPS-measured position and autonomous traveling is carried out.

The display 20 includes a liquid crystal display monitor and a processing content such as map information written by the host CPU 11 in the display memory 22 is read by a display controller 21 for display. According to the present invention, during the period between the supply of ACC power supply and the activation of the HDD or for a while after the activation, map information representing the position of the vehicle itself at the previous engine termination which has been written in the backup RAM 27 is displayed.

The input device 19 is a remote control device or console used as a GUI for inputting commands or communication between the navigation system and the display 20. The voice sound processing circuit 23 serves as a GUI by emitting a voice sound guide or receiving an input voice sound for communication with the navigation system. The voice sound guide is output through the speaker 24. 25 denotes a power supply circuit for vehicle, which includes a normal power supply line and an ACC power supply line as described above.

Fig. 2 is a diagram showing in detail the configuration of the HDD 15 and the in-vehicle power supply circuit 25 in Fig. 1 and an engine start detecting device 30 for detecting the start of the engine.

The above described host interface circuit 5, the internal CPU 152, the program memory 153, the data memory 154, and the HDD interface circuit 155 are connected in common to the HDD system bus 150.

The internal CPU 152 receives a command (such as Seek, Read/Write) from the host CPU 11 in Fig. 1 through the host interface 151, and carries out the command control through the HDD interface circuit 155 according to a program stored in the program memory 153. Data read/written from/to a magnetic disk through the magnetic head is controlled by the R/W circuit 156, while the VCM motor 160 is driven under the control of the head driving control circuit 157. The spindle motor 161 is driven under the control of the spindle motor control circuit 158. Note that counter electromotive force generated by the inertial rotation of the spindle motor when the power

supply is off is supplied from the spindle motor 161 to the head driving control circuit 157 through a line 170.

The engine start detecting device 30 includes a voltage value monitoring circuit 301, a threshold setting circuit 302, an engine start detecting circuit 303, and a group of sensors 304. The voltage value monitoring circuit 301 monitors the voltage values on the power supply lines 251 and 252 supplied from the two power supplies described above, and notifies the engine start detecting circuit 303 of the values. A threshold value to detect a momentary shutoff is set at the threshold setting circuit 304, and the engine start circuit is notified of the value. The engine start detecting circuit 303 obtains voltage value data from the voltage value monitoring circuit 301 and the threshold setting circuit 302 and then supplies an activation signal to the HDD in response to a detected engine start timing according to the process as will be described.

The engine start detecting circuit 303 is connected with the group of sensors 304 as an option. In this case, a signal to trigger detection of the engine start timing must be received and internal program-wise determination is necessary without the voltage value monitoring operation as described above. Therefore, program logics by microcomputers or the like are used for monitoring and control. In this case, as the group of sensors 304, a tachometer, a vibration sensor, a starter-motor, a generator and the like would thus be necessary in addition to the sensor 16 provided as part of the car navigation system. These will be detailed.

A timer LSI (14) has a time count value set in a programmable manner by a host CPU (11), issues an interrupt at time up, and allows the interrupt routine to take over the processing. Here, the timing of activating the HDD after the start of the engine is specified.

The timing of activating the HDD according to the present invention will be now described in detail. According to the embodiment, at the start of the engine, the HDD is activated after a prescribed time period counted by the timer, so that the number of emergency unloading occurrence is reduced.

Fig. 3 is a timing chart for use in illustration of the timing of activating the HDD using the timer. In Fig. 3 (a) shows the voltage waveform on the normal power supply line 251 and (b) shows the voltage waveform on the ACC power supply line 252. SL (threshold value) represents a prescribed voltage value, 9V for example according to the embodiment. This voltage is set such that the voltage value at a momentary shutoff in the vehicle is lower than the voltage value SL.

The driver inserts the engine key in the LOCK position to release the lock, and turns the key to the ACC position (I). Thus, the ACC power supply rises for example to 12V, and the key is then turned to the START position (II) through the ON position (II), which starts the starter-motor and voltage

rises both on the normal power supply line 251 and the ACC power supply line 252. After a prescribed time period, the engine starts (IV), and the voltages on the ACC power supply line 252 and the normal power supply line 251 rise again to the original voltage value 12V, and a steady state is re-gained. Note that the time period between the ACC position, the start of the starter-motor and the start of the engine is random.

The driver inserts the engine key in the LOCK position to release the lock, and turns the key to the ACC position. Thus, the ACC power supply rises. Then, the timer LSI 14 starts counting. The starter-motor starts by the turning of the key to the ST position via the ON position, and the voltages on the normal power supply line 251 and the ACC power supply line 252 both fall. After the rotation of the starter-motor for a prescribed time period, the ACC power supply line 252 and then the normal power supply line 251 rise, and a steady state is regained. The time period between the ACCON positions, the start of the starter-motor and the start of the engine is random.

In the embodiment of the present invention, the timer LSI 14 is pre-programmed to count five seconds, and starts counting from the ACC position and after five seconds, an instruction to allow the magnetic head 51 to move is issued to the HDD 15 from the host CPU 11. More specifically, according to the embodiment, the timer is used because , an instantaneous rupturing part (A) in the figure may not be lower than the prescribed threshold value SL, and thus the number of emergency unloading occurrence can be minimum.

The HDD 15 receives the instruction signal at the internal CPU 152, and then the magnetic head 51 is allowed to move in response to an instruction from the internal CPU 152.

Note that in the embodiment described above, the magnetic head 51 is allowed to move after the timer has counted a prescribed time period, while the HDD may be kept off before the start of the engine, and turned on when the engine start is detected by the above described part.

Fig. 4 is a timing chart for use in illustration of the timing of activating the HDD using the timer. In this figure, the members denoted with the same reference characters as those in Fig. 2 carry out the same operation, and therefore are not described.

Here, after five seconds, the voltage value on the normal power supply line 251 or the ACC power supply line 252 is monitored and if the value is lower than the threshold value SL, the timer is restarted, and the HDD is activated after three seconds.

Thus, if the engine has not started after the set five seconds, the HDD 15 is activated after another three seconds. Therefore, it may take some time for the engine to start.

This operation may be repeated a number of times.

Figs. 5 and 6 show embodiments according to which the timer is used and the values of the power supply voltages in the vehicle are monitored and the HDD is activated when prescribed conditions are met.

According to the embodiment shown in Fig. 5, the power supply voltages both on the normal power supply line 251 and the ACC power supply line 252 are monitored. The driver inserts the engine key in the LOCK position to release the lock. The ACC power supply rises at the time (timing I) when the key is turned to the ACC position. Then, the voltage value monitoring circuit 301 starts monitoring the voltage values and the timer LSI 14 starts counting.

Then, when the engine key is turned to the ST position (III) to start the starter-motor, the voltages on the normal power supply line 251 and the ACC power supply line 252 both rise by the instantaneous rupturing described above. When the voltage values are lower than the prescribed threshold level SL, the voltage value monitoring circuit 301 can detect its monitoring voltage being lower than the prescribed threshold level SL. Thus, during the period from (III) to (IV), when the voltage values on the normal power supply line 251 and the ACC power supply line 252 by the instantaneous rupturing are lower than the prescribed threshold level SL, the time point at which these voltage values once again exceed the threshold level SL is detected, and the start of the engine can be detected. At the time, the HDD can be activated in the engine start timing (IV). Therefore, in this case, the HDD activation by monitoring using the timer is not carried out.

Meanwhile, during the period from (III) to (IV), the voltage values on the normal power supply line 251 and the ACC power supply line 252 by the instantaneous rupturing may not be lower than the prescribed threshold voltage level SL (denoted by the chain-dotted line). In this case, the start of the engine cannot be detected by monitoring the power supply voltage values, and therefore the HDD is activated using the timer as shown in Fig. 3.

When the engine start is detected or after five seconds counted by the timer, an instruction to allow the magnetic head 51 to move is issued to the HDD 15 from the host CPU 11.

As described above, according to the embodiment, the timing of activating the HDD varies depending upon the voltage level at a momentary shutoff. If the voltage value at a momentary shutoff is greater than the threshold level (such as the voltage value in Fig. 3 (A), the HDD is activated at the point (timing IV) when the engine start is detected based on the voltage value. Meanwhile, if the voltage value at a momentary shutoff is smaller than the prescribed threshold level SL, the HDD is activated when the timer LSI 14 counts a prescribed time period. Thus, the movement of the magnetic

head 51 is controlled to prevent emergency unloading.

In the embodiment shown in Fig. 6, when the engine in the vehicle has not started after a prescribed time period of five seconds following the activation of the timer LSI 14, in other words, if the voltage value on the normal power supply line 251 or the ACC power supply line 252 is still lower than the threshold value SL, the timer is restarted. Then, after a prescribed time period of another three seconds, the HDD is activated. The movement of the head is thus controlled to prevent the emergency unloading.

An embodiment will be described according to which a method of detecting an engine start using power supply lines connected to a key switch and a method of detecting an engine start using a timer are both employed to activate the HDD.

Fig. 7 is a diagram that power supply lines connected to the key switch 40 are added to Fig. 2. In this figure, the members denoted by the same reference characters as those in Fig. 2 carry out the same operation, and therefore will not be described in connection with the embodiment.

As shown in Fig. 7, the key switch 40 is connected with a normal power supply line 251 indicating the voltage value when the engine key is at the LOCK position, an ACC power supply line 252 indicating the voltage value when the engine key is at the ACC position, a power supply line 253 indicating the voltage value when the engine key is at the IG position and a power supply line 254 indicating the voltage value when the engine is started.

Fig. 8 is a diagram in the form of a timing charts for use in illustration of an embodiment according to which the HDD is activated by both monitoring using the timer and monitoring the voltage values on the power supply lines connected to the key switch. In the figure (a) shows the voltage waveform on the normal power supply line 251, (b) shows the voltage wave form on the ACC power supply line 252, (c) shows the voltage waveform on the IG power supply line 253 and (d) shows the voltage wave form on the ST power supply line 254, respectively. SL (threshold value) represents a prescribed voltage value, 9V for example according to the embodiment.

The driver inserts the engine key in the LOCK position to release the lock, and turns the key to the ACC position (I). Thus, the ACC power supply rises for example to 12V. At the time, the timer LSI (14) starts counting.

Then, when the engine key is turned to the ON position (II), the IG power supply rises and a power supply voltage is provided for example to a power window. Note that the timer LSI 14 may start counting at the time point (II). When the engine key is turned to the ST position (III), the starter-motor starts, the voltages on the normal power supply line 251 and the ACC power supply line 252 both fall because of a

momentary shutoff, and the voltage on the ST power supply rises. At the time, the voltage value monitoring circuit 301 detects the momentary shutoff based on the monitoring voltage lower than the threshold level SL. After a prescribed time period, the engine starts (IV), and the voltage values on the normal power supply line 251 and the ACC power supply line 252 rise to the original level and the ST power supply falls, so that a steady state is regained. The voltage value in the steady state can be detected to detect the start of the engine, and therefore at the time point, an instruction to allow the magnetic head 51 to move is issued to the HDD 15 from the host CPU 11.

Meanwhile, during the period from (III) to (IV), the voltage values on the normal power supply line 251 and the ACC power supply line 252 might not be lower than the prescribed threshold level SL by a momentary shutoff (denoted by the chain-dotted line). In this case, the engine starts in a vehicle cannot be detected by monitoring the power supply voltage values, and therefore the HDD is activated using the timer as shown in Fig. 3.

When the engine start is detected, or when the timer has counted five seconds, an instruction to allow the magnetic head 51 to move is issued from the host CPU 11 to the HDD 15.

Whether or not a power supply voltage is provided for starting the engine can be determined based on the voltage value on the ST power supply line 254. More specifically, since the ST power supply lien 254 rises only when a power supply voltage is supplied for starting the engine, the voltage value may be monitored for determination. If the voltage value on the ST power supply line 254 is greater than the prescribed threshold level SL, and then becomes lower than the value SL, the engine start can be detected, and therefore the HDD is activated after that. Meanwhile, if the voltage value on the ST power supply line 254 is not higher than the prescribed threshold level SL, the HDD may be activated after five seconds counted by the timer.

Then, when the engine start is detected or after the five seconds counted by the timer, an instruction to allow the magnetic head 51 to move is issued from the host CPU 11 to the HDD 15.

As in the foregoing, according to the embodiment, the voltage values on the four power supply lines, i.e., the normal power supply line 251, the ACC power supply line 252, the IG power supply line 253 and the ST power supply line 254 are monitored to surely detect the start of the engine, and the movement of the magnetic head 51 of the HDD 15 is allowed after the detection. Alternatively, time monitoring is additionally carried out using the timer LSI 14. when conditions of one of the monitoring methods are met, an instruction to allow the magnetic head 51 to move is issued from the host

CPU 11 to the HDD 15.

Therefore, emergency unloading caused by a momentary shutoff at the start of the engine can be avoided, and the collision between the magnetic head 51 and the ramp 55 at the start of the engine can be prevented. Note that in the above embodiments, after the engine start, the magnetic head 51 is allowed to move, while the HDD may be kept off before the engine start and may be turned on after the engine start is detected by the above described part.

As in the foregoing, according to the embodiments, the HDD is started after the engine in the vehicle is started, and therefore the emergency unloading at the start of the engine can surely be prevented. However, since in a navigation system, for example, map data is not displayed on the monitor screen before the HDD is activated, the user might feel insecure. Therefore, during the period between the ACCON and the start of the engine, a map stored in the backup RAM and indicating the position of the vehicle the last time the engine is stopped is preferably displayed. Besides the navigation system, in an HDD integrated music information reproducing apparatus, information (such as index information) to specify music information performed at the previous engine interruption which has been stored in the backup RAM 27 is preferably displayed.

[Effect of the Invention]

As described above, according to the present invention, in a recording and reproducing device driven using a power supply voltage in a vehicle, the start of the engine can be determined by timer monitoring even for a vehicle with no voltage drop at the start of the engine. Meanwhile, for a vehicle with a voltage drop, the recording and reproducing device may be started in an earlier timing. By allowing the head to move after the detection time point, the emergency unloading at the start of the engine can be prevented. Therefore, the number of emergency unloading can be reduced and the number of collisions between the head and the ramp is reduced. As a result, the head may have a prolonged life and the recording and reproducing device may have improved reliability as an HDD.

[Brief Description of the Drawing]

Fig. 1 is a block diagram showing the system construction of a car navigation system in which the recording and reproducing device for vehicles according to the present invention is mounted.

Fig. 2 is a block diagram showing details of the structure around the HDD, vehicle mounted power supply circuit in Fig. 1.

Fig. 3 is a timing chart cited for explaining the timing of activating an HDD using a timer.

Fig. 4 is a timing chart cited for explaining the timing of activating an HDD using a timer in connection with another embodiment of the invention.

Fig. 5 is a timing chart cited for explaining the timing of activating an HDD using a timer in connection with yet another embodiment.

Fig. 6 is a timing chart cited for explaining the timing of activating an HDD using a timer in connection with a still further embodiment.

Fig. 7 is a block diagram of the embodiment as shown in Fig. 2 with an additional circuit for monitoring each power supply line connected to an IG switch

Fig. 8 is a timing chart for illustrating the operation of an engine start detecting device in Fig. 7.

Fig. 9 is a diagram showing a plan view of a basic structure of the ramp-load type HDD.

Fig. 10 is a diagram cited for explaining the positional relationship between the ramp and the head.

Fig. 11 is a diagram showing the power supply line of the vehicle mounted audio product.

Fig. 12 is a timing chart cited for explaining the operational sequence of the vehicle mounted power supply circuit at the time of the engine starting.

[Brief Explanation of Reference Signs]

11... host CPU, 15... hard disc device (HDD), 16... sensor, 25... vehicle mounted power supply, 27... backup RAM, 30... engine start detecting device, 152... CPU built in HDD, 157... head drive control circuit, 161... spindle motor, 251... normal power supply line, 252... accessory (ACC) power supply line, 253... ignition (IG) power supply line, 254... starter (ST) power supply line, 301... voltage value detecting circuit, 302... threshold value setting circuit, 303... engine start detecting circuit, 304... various sensors

FIG.1

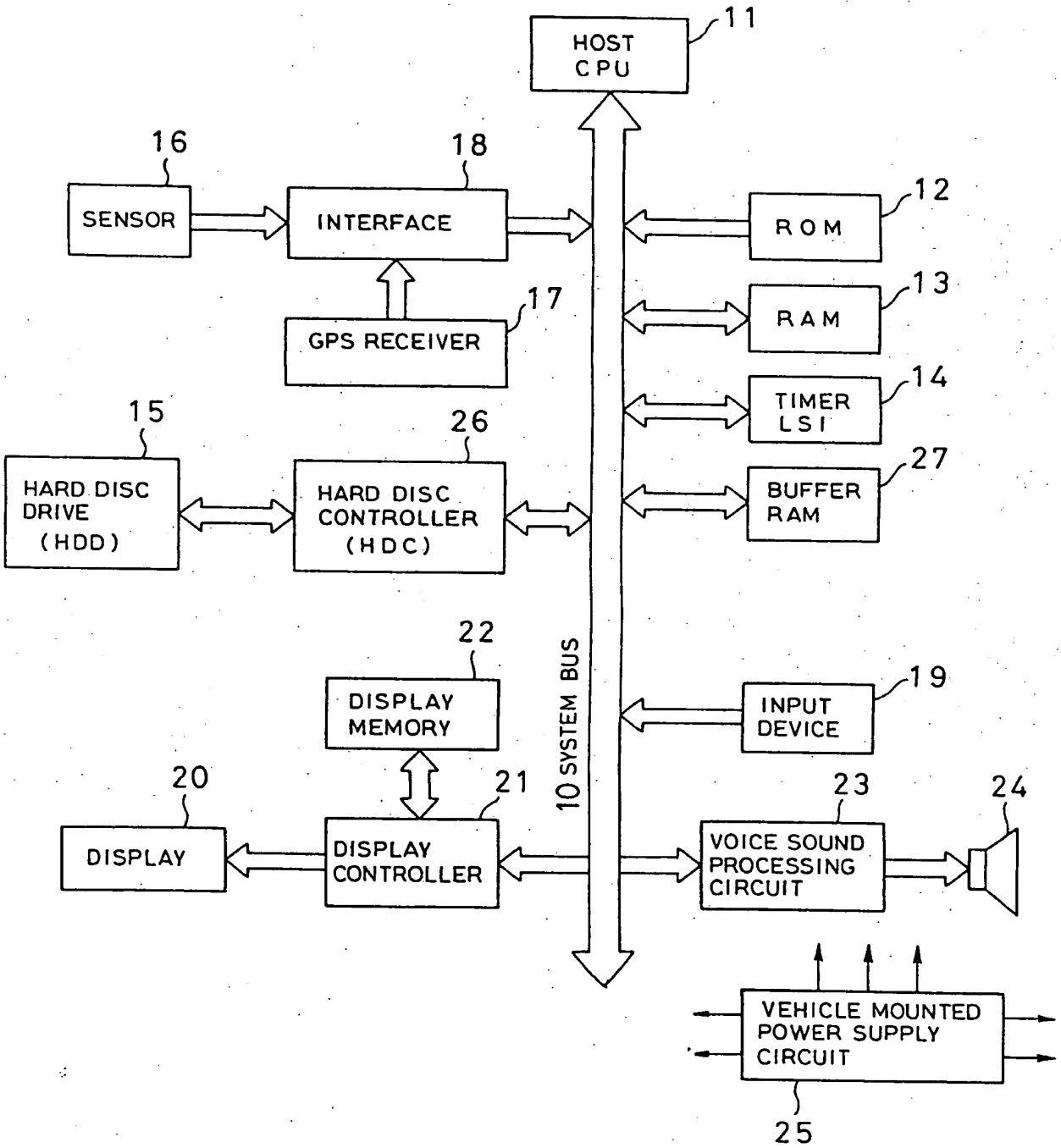

HOST CPU
11
16
18
SENSOR
INTERFACE
ROM
12
RAM
13
17
GPS RECEIVER
TIMER LSI
14
15
26
HARD DISC DRIVE (HDD)
HARD DISC CONTROLLER (HDC)
BUFFER RAM
27
22
DISPLAY MEMORY
10 SYSTEM BUS
INPUT DEVICE
19
20
21
23
24
DISPLAY
DISPLAY CONTROLLER
VOICE SOUND PROCESSING CIRCUIT
VEHICLE MOUNTED POWER SUPPLY CIRCUIT
25

FIG.2

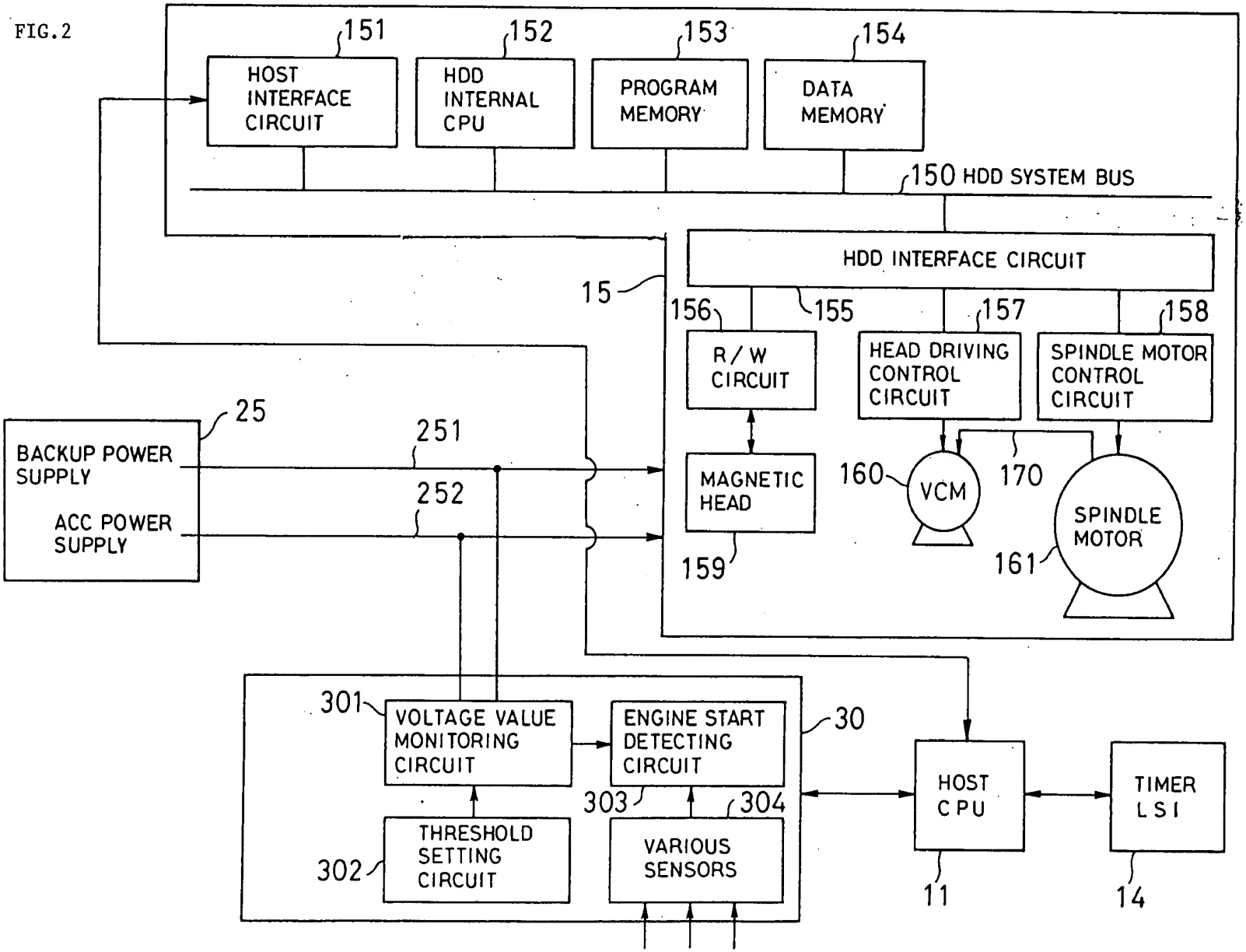

151
152
153
154
HOST INTERFACE CIRCUIT
HDD INTERNAL CPU
PROGRAM MEMORY
DATA MEMORY
150 HDD SYSTEM BUS
HDD INTERFACE CIRCUIT
15
156
155
157
158
R / W CIRCUIT
HEAD DRIVING CONTROL CIRCUIT
SPINDLE MOTOR CONTROL CIRCUIT
25
BACKUP POWER SUPPLY
ACC POWER SUPPLY
251
252
MAGNETIC HEAD
159
160
VCM
170
SPINDLE MOTOR
161
301
VOLTAGE VALUE MONITORING CIRCUIT
ENGINE START DETECTING CIRCUIT
30
303
304
THRESHOLD SETTING CIRCUIT
302
VARIOUS SENSORS
HOST CPU
TIMER LSI
11
14

FIG.3

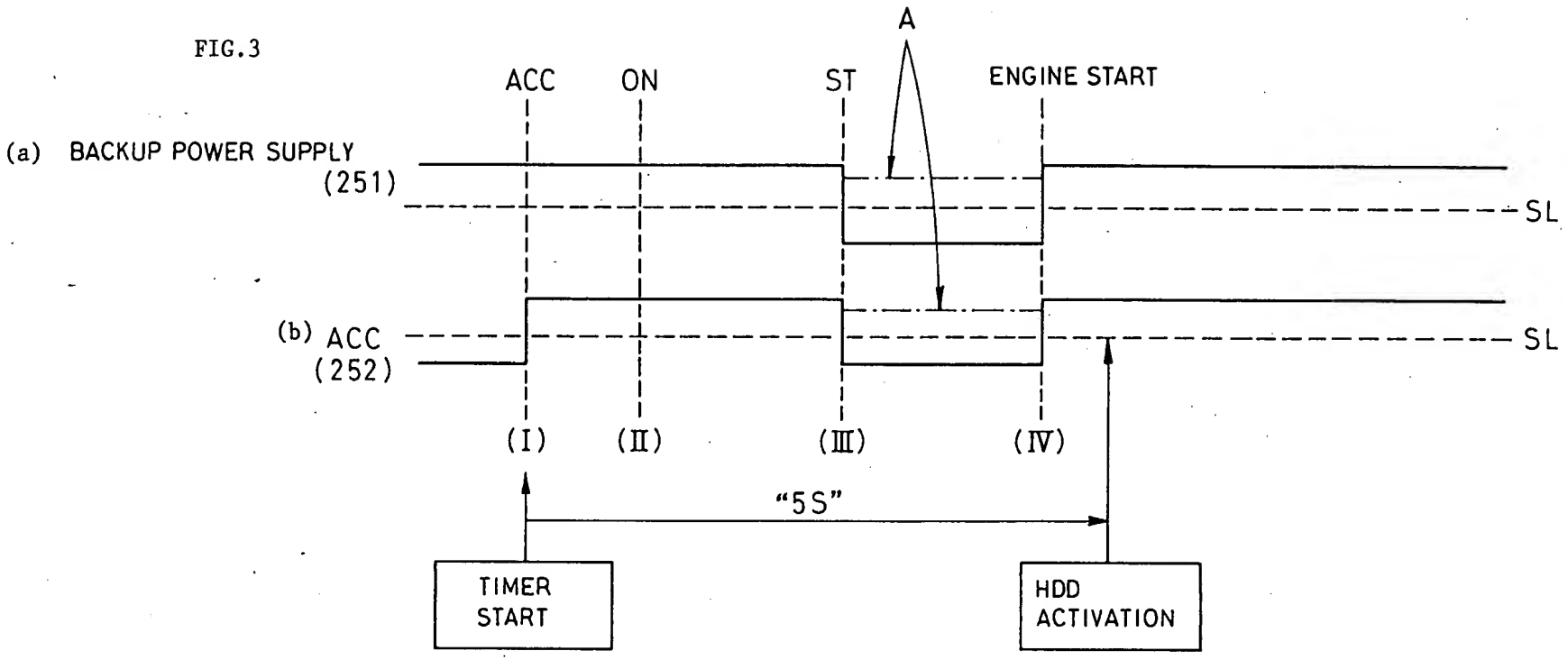

A
ACC
ON
ST
ENGINE START
(a) BACKUP POWER SUPPLY
(251)
SL
(b) ACC
(252)
SL
(I)
(II)
(III)
(IV)
"5S"
TIMER
START
HDD
ACTIVATION

FIG.4

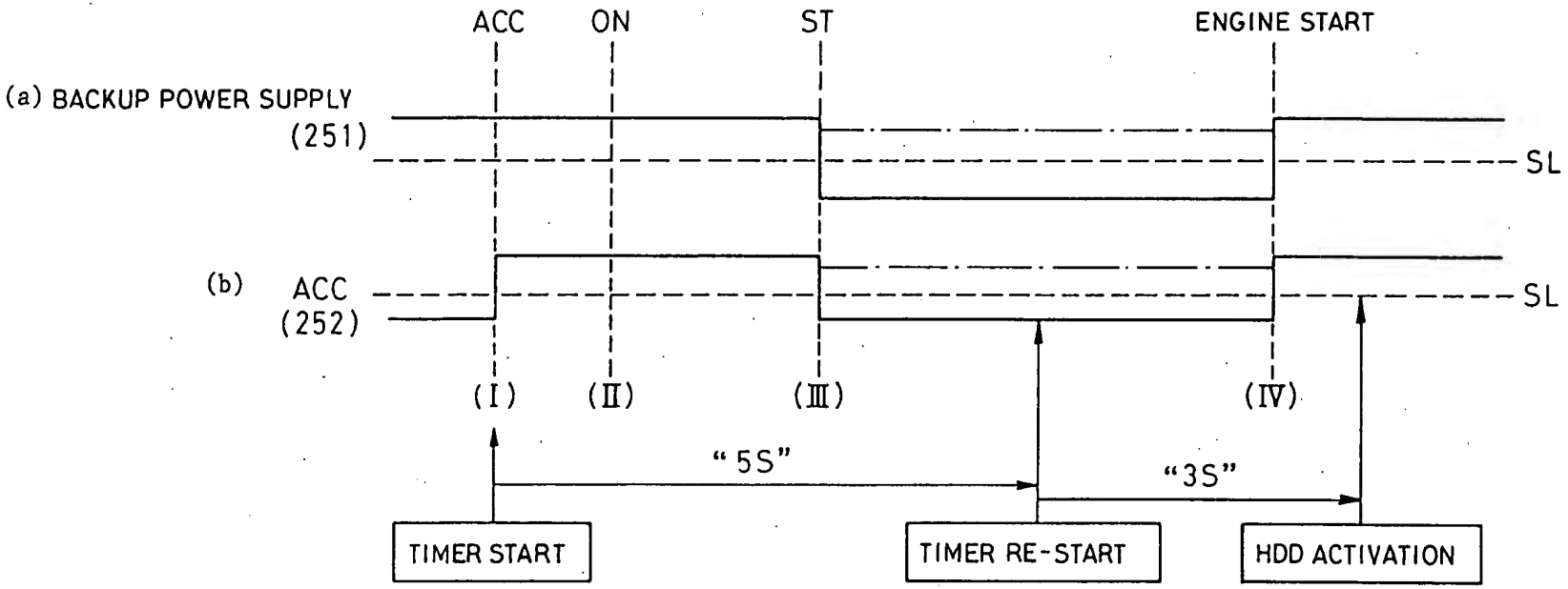

ACC
ON
ST
ENGINE START
(a) BACKUP POWER SUPPLY
(251)
SL
(b)
ACC
(252)
SL
(I)
(II)
(III)
(IV)
"5S"
"3S"
TIMER START
TIMER RE-START
HDD ACTIVATION

FIG.5

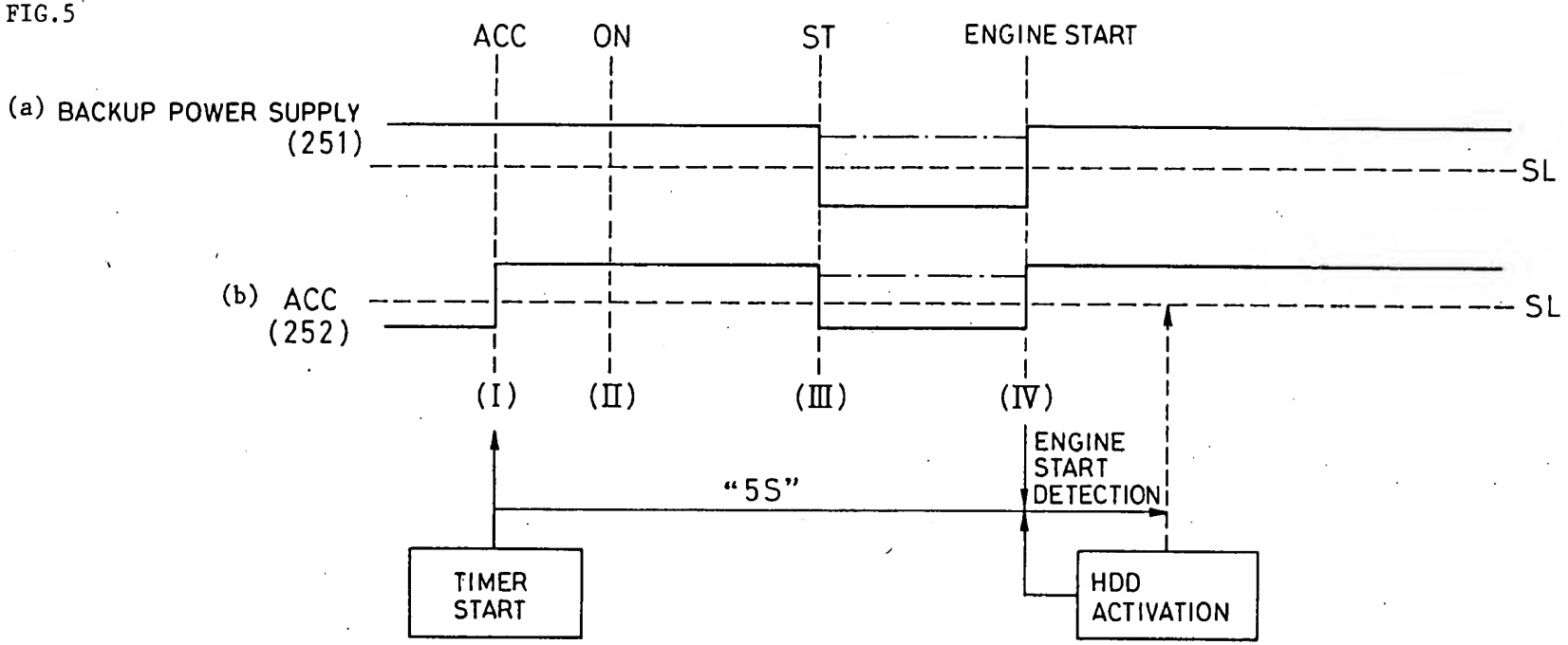

ACC
ON
ST
ENGINE START
(a) BACKUP POWER SUPPLY (251)
SL
(b) ACC (252)
SL
(I)
(II)
(III)
(IV)
ENGINE START DETECTION
"5S"
TIMER START
HDD ACTIVATION

FIG.6

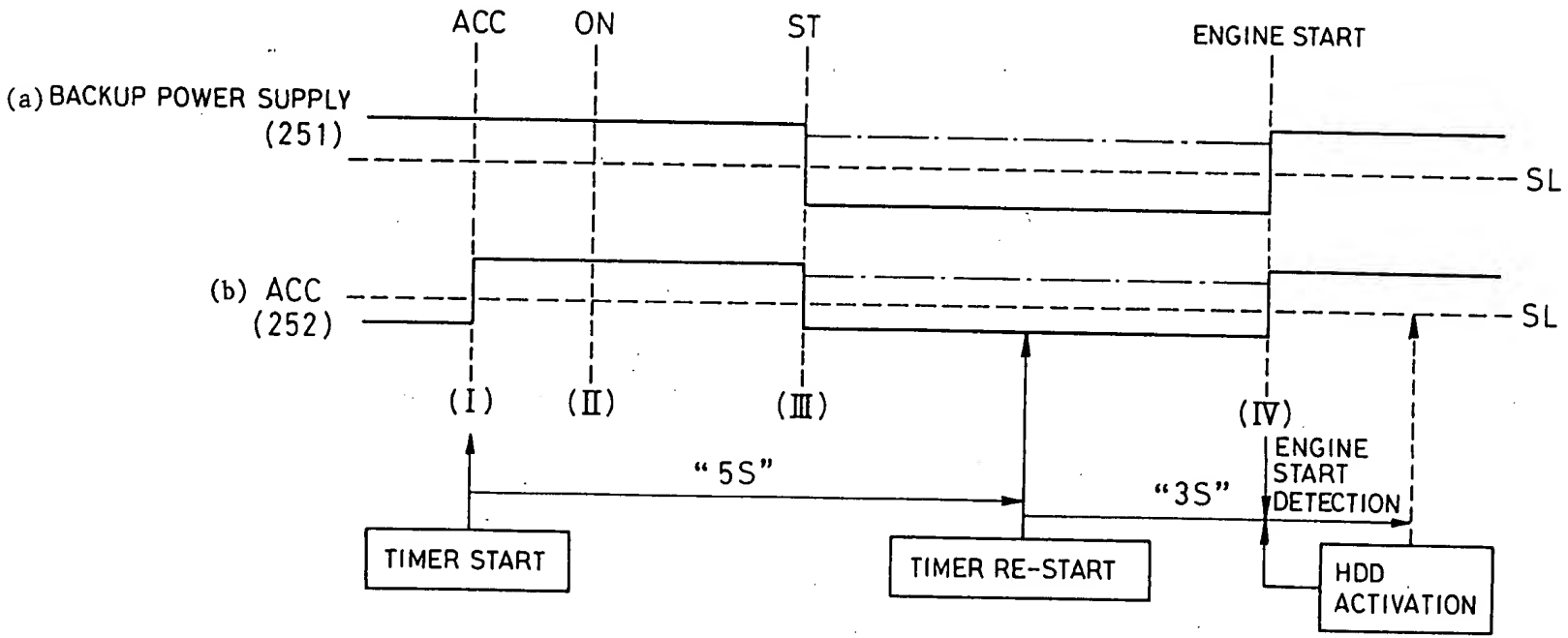

ACC
ON
ST
ENGINE START
(a) BACKUP POWER SUPPLY
(251)
SL
(b) ACC
(252)
SL
(I)
(II)
(III)
(IV)
"5S"
"3S"
ENGINE
START
DETECTION
TIMER START
TIMER RE-START
HDD
ACTIVATION

FIG. 7

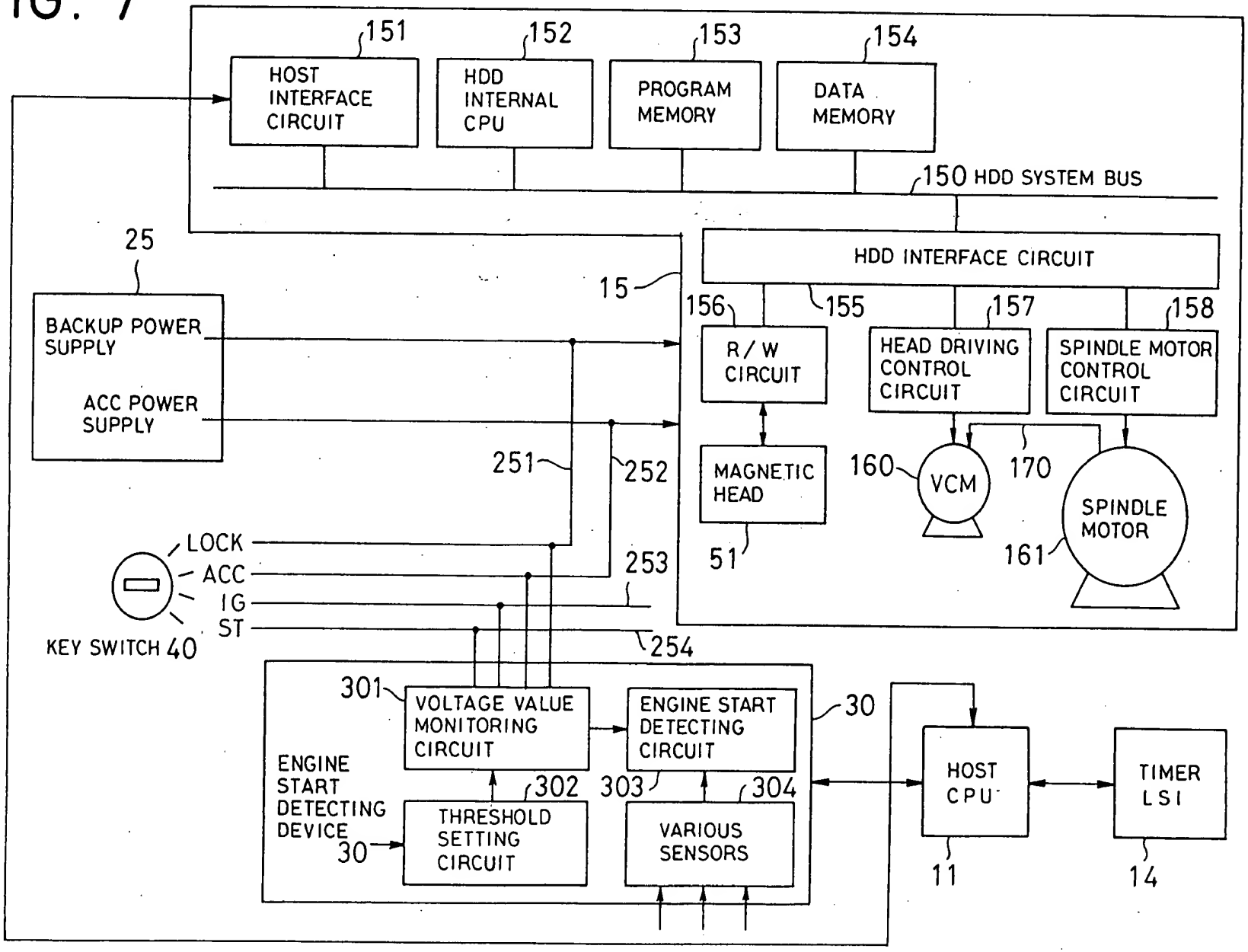

151
152
153
154
HOST INTERFACE CIRCUIT
HDD INTERNAL CPU
PROGRAM MEMORY
DATA MEMORY
150 HDD SYSTEM BUS
25
BACKUP POWER SUPPLY
ACC POWER SUPPLY
15
HDD INTERFACE CIRCUIT
156
155
157
158
R/W CIRCUIT
HEAD DRIVING CONTROL CIRCUIT
SPINDLE MOTOR CONTROL CIRCUIT
MAGNETIC HEAD
51
160
VCM
170
SPINDLE MOTOR
161
251
252
253
254
LOCK
ACC
IG
ST
KEY SWITCH 40
301
VOLTAGE VALUE MONITORING CIRCUIT
ENGINE START DETECTING CIRCUIT
30
ENGINE START DETECTING DEVICE
30
302
303
304
THRESHOLD SETTING CIRCUIT
VARIOUS SENSORS
HOST CPU
11
TIMER LSI
14

FIG.8

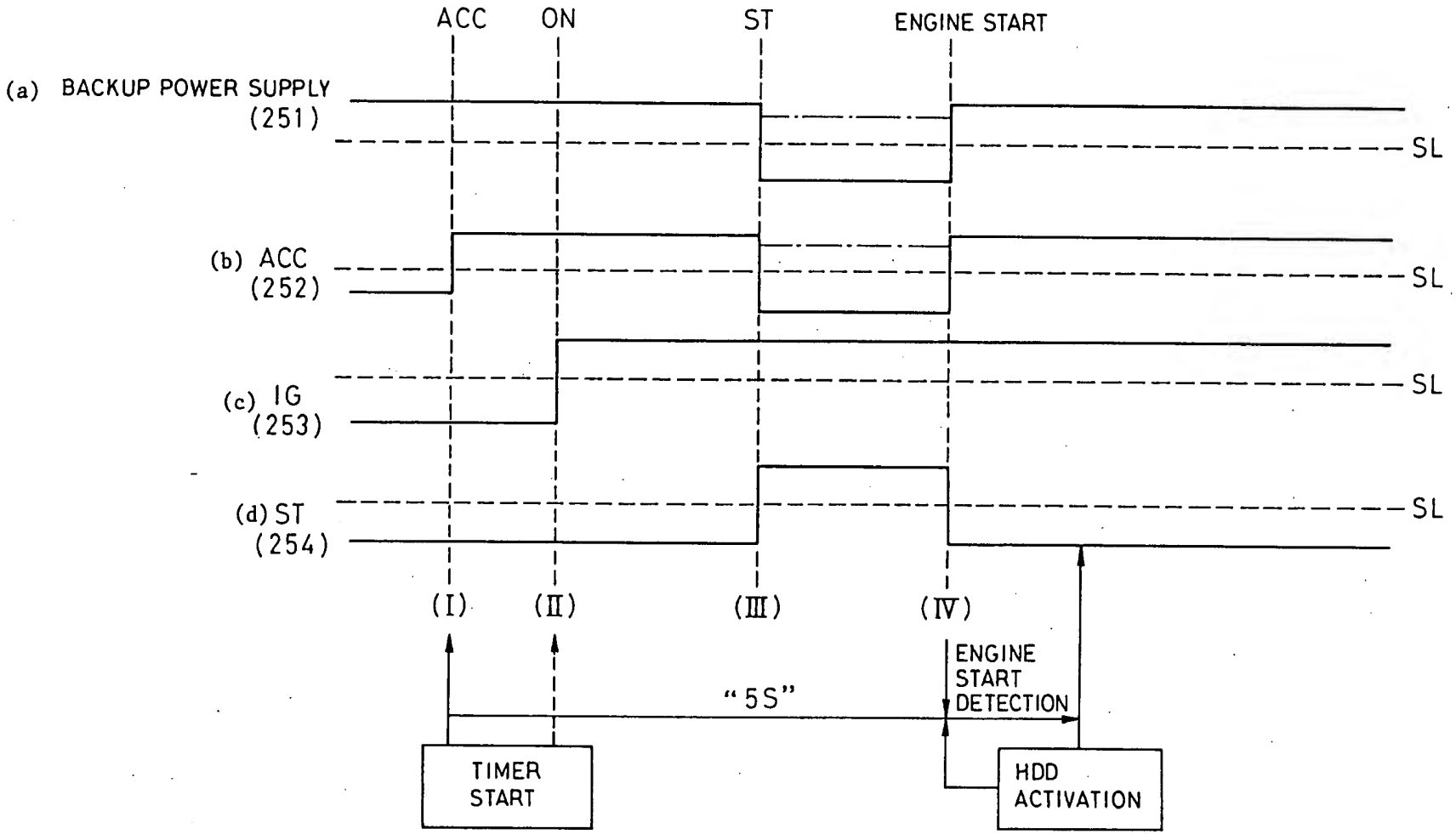

ACC
ON
ST
ENGINE START
(a) BACKUP POWER SUPPLY (251)
SL
(b) ACC (252)
SL
(c) IG (253)
SL
(d) ST (254)
SL
(I)
(II)
(III)
(IV)
"5S"
ENGINE START DETECTION
TIMER START
HDD ACTIVATION

FIG. 9

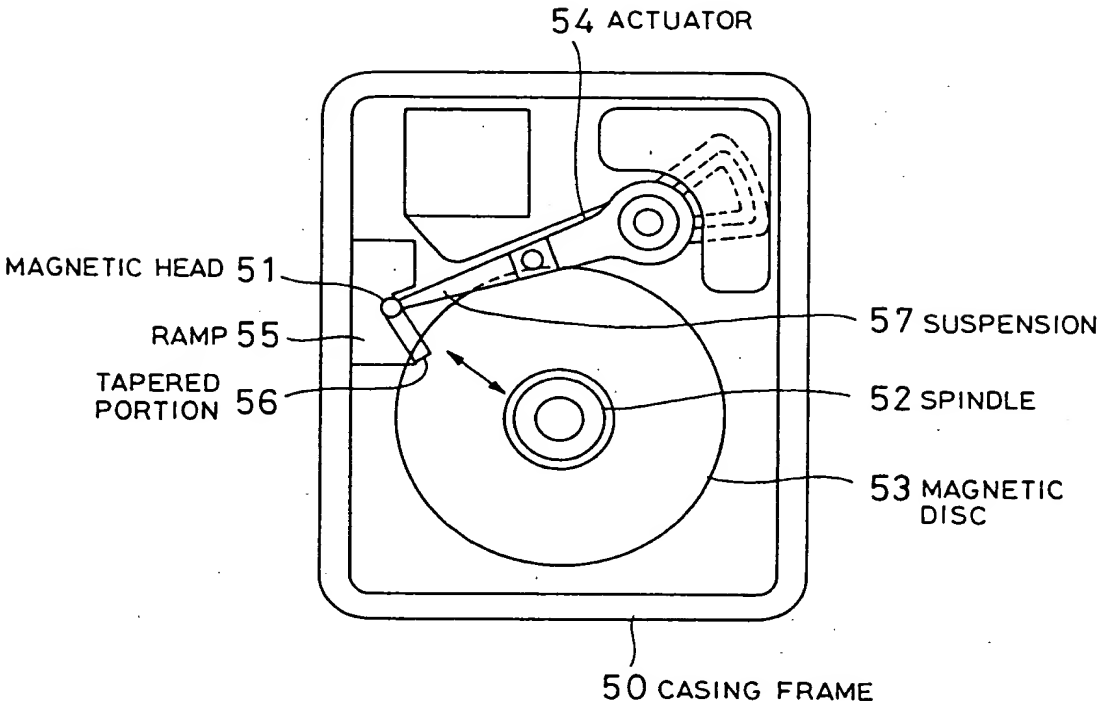

54 ACTUATOR
MAGNETIC HEAD 51
RAMP 55
TAPERED PORTION 56
57 SUSPENSION
52 SPINDLE
53 MAGNETIC DISC
50 CASING FRAME

FIG. 10

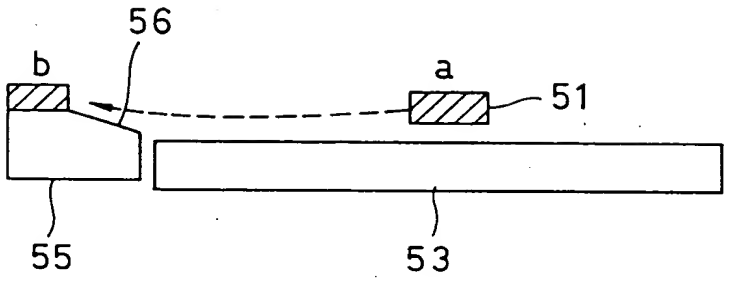


FIG. 11

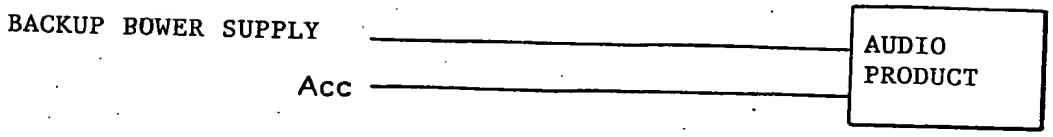
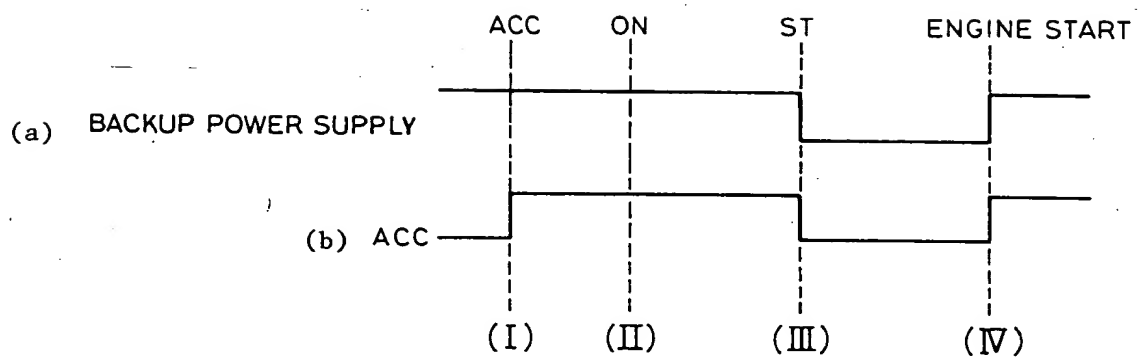


FIG.12



[Document Name] ABSTRACT

[Abstract]

[Object]

A recording and reproducing device in which emergency unloading at the start of the engine is prevented, so that a head's prolonged life is pursued and improved reliability as an HDD is achieved.

[Measure taken to attain the Object] Voltage values on two power supply lines (251, 252) for a vehicle power supply device 25 are monitored. The magnetic head is allowed to move when the voltage values on the first power supply line and the second power supply line 251 attain a prescribed value after the lapse of a prescribed time period (timer LSI 14) after the voltage value on the first power supply line 252 attains prescribed value.

[Selected Drawing] Fig. 3